

Chapter 1

$$\bar{v}_{\text{avg}} = \frac{\Delta \bar{d}}{\Delta t}$$

$$\bar{a} = \frac{\bar{v}_2 - \bar{v}_1}{\Delta t}$$

$$\Delta \bar{d} = \left(\frac{\bar{v}_1 + \bar{v}_2}{2} \right) \Delta t$$

$$\Delta \bar{d} = \bar{v}_1 \Delta t + \frac{1}{2} \bar{a} \Delta t^2$$

$$\times \Delta \bar{d} = \bar{v}_2 \Delta t - \frac{1}{2} \bar{a} \Delta t^2$$

$$\bar{v}_2^2 = \bar{v}_1^2 + 2\bar{a}\Delta d$$

$$\bar{F}_g = m\bar{g}$$

$$\bar{F}_{\text{net}} = m\bar{a}$$

$$F_f = \mu F_n$$

$$F_g = \frac{Gm_1 m_2}{r^2}$$

Chapter 2

$$R = \frac{v^2 \sin 2\theta}{g}$$

$$\bar{v}_{\text{og}} = \bar{v}_{\text{om}} + \bar{v}_{\text{mg}}$$

$$a_c = \frac{v^2}{r}$$

$$a_c = \frac{4\pi^2 r}{T^2}$$

$$a_c = 4\pi^2 r f^2$$

$$F_c = \frac{mv^2}{r}$$

$$F_c = \frac{m4\pi^2 r}{T^2}$$

$$F_c = m4\pi^2 r f^2$$

$$F_{g\parallel} = mg \sin \theta$$

$$F_{g\perp} = mg \cos \theta$$

$$\mu = \tan \theta$$

$$\frac{v^2}{gR} = \tan \theta$$

Chapter 3

$$\tau = rF_{\text{app}} \sin \theta$$

$$\text{Stress} = \frac{F}{A}$$

$$\text{Strain} = \frac{\Delta L}{L}$$

Chapter 4

$$\bar{p} = m\bar{v}$$

$$\bar{F} = \frac{\Delta \bar{p}}{\Delta t} = \frac{m\Delta \bar{v}}{\Delta t} = m\bar{a}$$

$$\bar{J} = \Delta \bar{p} = \bar{F}\Delta t$$

$$\Delta \bar{p}_{\text{total}} = 0$$

$$\bar{p}_{\text{total initial}} = \bar{p}_{\text{total final}} = \bar{p}_{\text{cm}}$$

Chapter 5

$$F = kx$$

$$W = F \cdot \Delta d = F\Delta d \cos \theta$$

$$E_k = \frac{1}{2}mv^2$$

$$E_e = \frac{1}{2}kx^2$$

$$E_k = \frac{p^2}{2m}$$

$$E_{\text{total}} = E_p + E_k$$

$$\Delta E_g = mg\Delta h$$

$$P = \frac{E}{t} = Fv$$

$$v_{1f} = v_{1o} \left(\frac{m_1 - m_2}{m_1 + m_2} \right)$$

$$v_{2f} = v_{1o} \left(\frac{2m_1}{m_1 + m_2} \right)$$

Chapter 6

$$E_p = \frac{-GMm}{r}$$

$$v_{\text{esc}} = \sqrt{\frac{2GM}{r}}$$

$$E_T = \frac{-GMm}{2r}$$

$$\frac{r^3}{T^2} = K$$

$$a = -\left(\frac{k}{m}\right)x$$

$$F = -kx$$

$$E_p = \frac{1}{2}kx^2$$

$$E_T = \frac{1}{2}kA^2$$

$$kA^2 = mv^2 + kx^2$$

Chapter 7

$$s = r\theta$$

$$\omega = \frac{\Delta \theta}{\Delta t}$$

$$v = r\omega$$

$$a = r\alpha$$

$$\alpha = \frac{\Delta \omega}{\Delta t}$$

$$a = r\omega^2$$

$$\alpha = \frac{\omega_2 - \omega_1}{\Delta t}$$

$$\Delta \theta = \frac{1}{2}(\omega_1 + \omega_2)\Delta t$$

$$\Delta \theta = \omega_1 \Delta t + \frac{1}{2}\alpha \Delta t^2$$

$$\Delta \theta = \omega_2 \Delta t - \frac{1}{2}\alpha \Delta t^2$$

$$\omega_2^2 = \omega_1^2 + 2\alpha \Delta \theta$$

$$\tau = \bar{r} \times \bar{F} = rF \sin \theta$$

$$\tau = I\alpha$$

$$I_{\text{total}} = I_{\text{cm}} + ml^2$$

$$W_R = \tau\theta$$

$$E_{k\text{rotational}} = \frac{1}{2}I\omega^2$$

$$L = I\omega$$

$$\Sigma I_i \omega_i = \Sigma I_f \omega_f$$

Chapter 8

$$F = \frac{kq_1 q_2}{r^2}$$

$$\bar{F}_e = q\bar{E}$$

$$\bar{E} = \frac{kq_m}{r^2}$$

$$\Delta V = \frac{\Delta E_e}{q} = \frac{W_{12}}{q}$$

$$\frac{1}{2}mv_2^2 = q(V_1 - V_2)$$

$$E_e = \frac{kq_1q_2}{r}$$

$$\mathcal{E} = \frac{V}{d}$$

$$V = \frac{kq}{r}$$

Chapter 9

$$F = BIL \sin \theta$$

$$B = \frac{\mu I}{2\pi r}$$

$$B = \frac{\mu NI}{2r}$$

$$B = \frac{\mu NI}{L}$$

$$F = qvB \sin \theta$$

$$m = \frac{qB^2r^2}{2V}$$

Chapter 10

$$T = \frac{1}{f}$$

$$v = \lambda f$$

$$c = \lambda f$$

$$y = A \sin \theta$$

$$x = A \cos \theta$$

$$n = \frac{c}{v}$$

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

$$I_1 = \frac{1}{2}I_0$$

$$I_2 = I_1 \cos^2 \theta$$

$$\tan \theta_B = \frac{n_2}{n_1}$$

Chapter 11

Double Slit and Diffraction Grating

$$m\lambda = |P_m S_2 - P_m S_1|$$

(constructive interference)

$$m\lambda = d \sin \theta_m$$

$$m\lambda = \frac{dx_m}{L}$$

$(m + \frac{1}{2})\lambda$ (destructive interference)

$$\lambda = \frac{d\Delta x}{L}$$

$$R = Nm = \frac{\lambda}{\Delta \lambda}$$

$$\lambda_m = \frac{\lambda}{n_m}$$

$$\Delta PD = \left(\frac{2t}{\lambda}\right)(n_m - 1)$$

Single Slit

$$m\lambda = w \sin \theta_m$$

(destructive interference)

$$m\lambda = \frac{wx_m}{L}$$

$(m + \frac{1}{2})\lambda$ (constructive interference)

$$\lambda = \frac{w\Delta x}{L}$$

$$\theta_R = \frac{1.22\lambda}{d}$$

$$m\lambda = 2d \sin \theta$$

Chapter 12

$$\lambda_{\max} = \frac{2.898 \times 10^{-3}}{T}$$

$$E = hf = \frac{hc}{\lambda}$$

$$E_{k_{\max}} = E_{\text{photon}} - W_0$$

$$p = \frac{h}{\lambda}$$

$$E_{x\text{-ray}} = hf_f + \frac{1}{2}mv^2$$

$$\Delta p_y \Delta y \geq \frac{h}{2\pi}$$

$$\Delta E \Delta t \geq \frac{h}{2\pi}$$

$$L_n = mv_n r_n$$

$$r_n = \frac{\hbar^2 n^2}{m_e k e^2}$$

$$r_n = \frac{5.29 \times 10^{-11} \text{ m}}{n^2}$$

$$E_n = \frac{-2.18 \times 10^{-18} \text{ J}}{n^2}$$

Chapter 13

$$t = \frac{t_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$L = L_0 \sqrt{1 - \frac{v^2}{c^2}}$$

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$p = \frac{m_0 v}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$E = mc^2 = \frac{m_0 c^2}{\sqrt{1 - \frac{v^2}{c^2}}} = m_0 c^2 + E_k$$

$$E = m_0 c^2 + qV \text{ (linacs)}$$

$$(m_0 v c)^2 + (m_0 c^2)^2 = (m c^2)^2$$

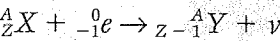
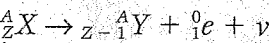
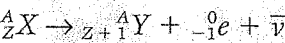
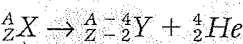
$${}_{A'}\vec{v}_c = \frac{{}_A\vec{v}_B + B\vec{v}_C}{1 + \frac{{}_A\vec{v}_B \cdot B\vec{v}_C}{c^2}}$$

$$(\Delta s)^2 = c^2(\Delta t)^2 - (\Delta x)^2$$

$$r = \frac{m_0 v}{Bq \sqrt{1 - \frac{v^2}{c^2}}}$$

Chapter 14

$$\Delta m = \frac{\Delta E}{c^2}$$



$$N = N_0 \left(\frac{1}{2}\right)^{\frac{t}{T_{1/2}}}$$

$$r = 1.2\sqrt{A} \text{ (fm)}$$

$$\text{Activity} = \frac{0.693N}{T_{1/2}}$$